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ABSTRACT

This paper presents two types of approaches to media selection--rational-choice approaches and social-influence approaches. It is argued that designers should combine the two types of approaches in a bottom-up/top-down media-selection process. As examples of the two types of approaches, two conceptual frameworks are described--task/media fit and core/complementary media. The complementarity of the two choices is also discussed. In summary, the following three guidelines are listed: (1) consider for each educational-design situation what is an "objectively" optimum choice for each particular task (rational-choice approach), and combine this with the best choice within the social context (social-influence approach); (2) consider task/media fit as a rational-choice framework and core/complementary media as a social-influence framework for thinking about media selection; and (3) approach media selection as a creative and heuristic, combined bottom-up/top-down design process, in which these guidelines may serve as resources. One figure illustrates task/media fit according to media richness theory. (Author/DLS)

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Guidelines for Media Selection

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Abstract: Media selection is a key step in the educational design process. We present two types of approaches to media selection: *rational-choice approaches* and *social-influence approaches*. We argue that designers should combine these two types of approaches in a combined bottom-up/top-down media-selection process. Furthermore, as examples of the two types of approaches, we describe two conceptual frameworks: *task/media fit* and *core/complementary media*, respectively. These may help designers in finding a balance between an 'objectively' optimum choice and factors in the implementation context.

1. Introduction

A new machine, a new course... Marian is a training developer in the company that introduces this new machine, and she takes on her task in a thorough way: after analyzing the problem and the task, she uses a well-known model for media selection to decide on the instructional medium. A computer simulation is developed, with a series of built-in assignments, which allows operators to develop insight into the production process and the ways in which they may control this process by using the features of this new machine. Operators may use such a computer simulation independently, in the work place, at those moments that suit them best.
The computer simulation, once ready, yields many positive responses from Marian's colleagues. However, it is never really implemented. Operators do not have any experience with computer simulations, and their managers prefer to send them on a half-day course, from which they return with a file of course materials and a manual.

What went wrong in this example? Something in the introduction process? Or was the media-selection decision not feasible? Media selection: a second example.

Jack develops and gives management and communication training. Role play is a common ingredient: it is effective and cheap to implement. For a new course about managing immigrant employees, Jack develops a number of role plays. Course members take turns to play the roles of, for example, a young Moroccan shop-girl and her manager.
Already the first time that the course is given, the decision on role play as the educational medium does not appear to be such a good one. Course members have difficulties identifying themselves with the role of the foreign shop-girl, and doubt whether they are able to apply the theory from the course materials in their work settings.

Media selection, often it is a decision taken implicitly. "Management wants more computer-assisted instruction", and thus the training design includes CAI. Or it is force of habit that determines the media selection, as in Jack's case. A quite different approach is the systematic, conscious and explicit media selection process. All those media selection models in the literature are there to be used, aren't they? Marian, in the first example above, utilizes such a model. However, the products of both Marian and Jack fail.

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In both cases media selection is a critical success factor. In this paper we focus our attention to media selection as one step in the process of educational design. In doing so, we acknowledge that the concept 'media' is hard to define: sometimes hardware aspects are critical in the selection, sometimes aspects of the organization of information and communication – the software. We will not go into this distinction, as this seems not to be a concern of instructional designers in practice.

In this paper we introduce two types of approaches to media selection, of which Marian's and Jack's way of working are examples. Marian's approach is what we call a 'rational-choice approach', while Jack's is an example of a 'social-influence approach' to media selection. The examples above show that neither of the two approaches is superior – the 'truth' will be somewhere in the middle. Where exactly? That is something that instructional designers will best be able to determine themselves, per specific situation for which they have to select media. This presentation does not contain any prescriptions – just because prescriptions do not apply to all cases of media selection: every concrete training situation is different. We are convinced, however, that insight into the foundation of the arguments that designers use (maybe unconsciously) in selecting media will help them find the optimum middle more effectively.
We thus aim to contribute to the toolbox of frameworks, methods and techniques that educational designers use in their daily practice. Besides an introduction to the two types of approaches, we present two specific conceptual frameworks which we have experienced to function well in practice. The framework of 'task/media fit' is an example of a rational-choice approach, while the 'core/complementary media' framework fits within the social-influence approach. In addition, we will argue that educational designers should always combine a rational-choice approach with a social-influence approach, making the media-selection process a combined bottom-up/top-down design process.

2. Rational-Choice and Social-Influence Approaches to Media Selection

Media selection is an important step in the design process for education and training. We distinguish two types of approaches to making decisions on media to use: rational-choice and social-influence approaches [Fulk et al. 90]. For reasons of clarity of our argumentation we will draw the differences between these two approaches more into extremes than is common practice.

Marian's media-selection decision is made according to a task analysis and a model for media selection, and as such is an example of a *rational-choice approach*. Characteristic to rational-choice approaches is [Fulk et al. 90]:

- every medium has fixed, inherent characteristics
- every task can be defined in terms of objective characteristics
- media selection is an independent, rational task
- media selection is motivated by a strive for efficiency

Media selection according to a rational-choice approach is often a matter of finding a best 'fit' between characteristics of the task and characteristics of the medium. In practice, this means:

- media selection takes place for specific educational tasks
- media selection is a bottom-up design process that starts from considering the educational tasks

Rational-choice approaches are often worked out in the form of prescriptive media-selection models. [Reiser & Gagné 82], [Romiszowski 88] and [Sorenson 91] collected a large number of such models. Many of these are in the format of a flow-chart, a matrix, or a worksheet. This makes them look very practical, but the large collection of models indicates that this is not the same as being applicable in a large variety of situations.

Jack's 'unconsciously made' media-selection decision is an example of a *social-influence approach* of media selection. Characteristic to this type of approach is [Fulk et al. 90]:

- characteristics of media and of 'good media selections' are determined in and through a social context, and thus are variable
- social influencing of media characteristics may take place...

- through overt statements of various people (e.g., colleagues) about media characteristics, task characteristics and media selections – statements which decision makers consider in their own evaluations of media characteristics
- if decision makers subsequently express these opinions to their colleagues in the context of specific decision-making situations, thereby making them even more salient
- through vicarious learning, through observations of success or failure of others' media selections

- media selection is not an independent task; however, selections can be rationalized retrospectively for the specific situation to which they applied – thus media selection is a subjectively rational task
- media selection may be motivated by a strive for efficiency, but this does not need to be so.

Media selection according to social-influence approaches is again about finding a 'fit' between characteristics of the task and of the medium. However, unlike rational-choice approaches, various interpretations of these characteristics and of the final decision are considered, all of which are constructed in a social context. This makes media selection a subjective process. In practice this implies that:

- media selection takes place for a larger whole of educational tasks
- media selection is a top-down design process which starts from current ideas about 'good' media selections for the educational setting

In general, social-influence approaches to media selection are not worked out in the form of handy, ready-to-use models. Recognition of social-influence processes, though, may help to rationalize, understand, appreciate, and accept or improve 'practice'.

We have introduced two types of approaches to media selection: rational-choice and social-influence approaches. Next we will discuss two specific conceptual frameworks that each are an example of one of these two approaches, and that offer a limited but useful perspective in the practice of media selection:

- task/media fit (a rational-choice approach)
- core/complementary media (a social-influence approach).

3. A Rational-Choice Approach to Media Selection: Task/Media Fit

The 'rational-choice approach' for media selection discussed below is based on the idea that characteristics of the educational task and characteristics of media used to accomplish this task should be aligned in order to achieve the best 'task/media fit'. The task/media-fit framework is based on 'media richness theory', which has been developed within management theory and communication science (see for example [Daft & Lengel 84], [Daft et al. 87]), and was adapted for educational settings by [Heeren 96].

With regard to the educational *task*, its complexity as a communication task is considered (the form of communication is determined by the educational method). 'Complexity' refers to the extent in which it is necessary to reduce potential differences in interpretations of the task content. Knowledge transfer of a series of concepts is an example of a moderately complex communication task between knowledge source (teacher, book) and learner. Transfer of motor skills is already more complex, which also deals with the communication between knowledge source and learner, but probably much more fine-tuning is required for a satisfactory transfer. Examples of rather complex tasks are negotiation among learners, or collaborative decision making – tasks in which differences in interpretation of case elements existing among participants need to be solved.

Media are considered with regard to the 'richness' they offer. Various dimensions of richness are distinguished, which also differ in importance depending on the specific situation. Examples of medium richness include: an audiovisual medium is 'richer' than a medium that offers audio only, which is again richer than a text medium. Also, a medium that supports direct interaction, such as an interactive computer simulation, is considered richer than a medium that offers feedback only after some time, such as a written test.

In order to derive a good fit, task/media combinations should be chosen within a '*band of good fit*', indicated in [Fig. 1]: complex tasks require a rich medium, for simple tasks a 'lean' medium is a better choice. An example: for a negotiation task a face-to-face role-playing game (rich medium) is a good choice; for knowledge transfer which requires reflection activities in the learner, relatively lean media such as written materials are a good choice.

In practice, often the 'richest possible' medium is selected. Rich media are most often also more costly. If the richness of the medium is not necessary to achieve the learning goal, too much money is spent (*efficiency loss*).

The costs which determine efficiency are measured not only in terms of money, but also in terms of time or effort. For example, adding moving images to a simple presentation is not only more expensive, but also diverts a learner's attention.
In case of a too lean medium, however, *effectiveness loss* may occur. Selecting electronic mail as the only medium for team work on solving a problem, for example, is asking for trouble – the medium is not interactive enough to support this process well, and will lead to loss of quality and effectiveness.

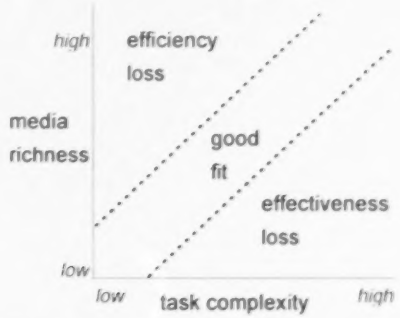

Figure 1: Task/media fit according to media richness theory.

Admittedly, the danger of effectiveness loss should not be overestimated. People have the capacity to easily adapt to a somewhat too lean medium by exerting more effort (a precondition is that they possess the skills to compensate for the lack of richness of the medium). It is interesting to relate this to a motivational and instructional-design aspect: if learners are challenged to utilize their skills, they will be more motivated to fulfill the task and to exert more effort on their task performance, which in turn may lead to deeper processing and, as a result, to better learning [Salomon 84]. Of course, the extra effort should be 'well spent': for example, effort exerted on overcoming the shortcomings of a badly designed user interface does not contribute to learning [Heeren 96]. Furthermore, [Heeren 96] showed that various media may be effective and efficient in a certain situation, or fall within a 'band of good fit'; see [Fig. 1]. Therefore, for achieving optimum learning effect, the leaner of these media should be chosen.
According to the task/media-fit framework in [Fig. 1], for each of the communication tasks within the series of educational tasks of a course a well-fitting medium should be selected. This means that media selection should take place when the instructional design is worked out in detail, often at the same time as the educational method for each task is chosen. Media selection thus is an activity in a bottom-up instructional-design process. The final media mix for a complete course then is the sum of a series of media selections for different educational tasks.
In summary, media selection according to the rational-choice task/media-fit approach is balancing between effectiveness loss and efficiency loss, by choosing a medium that is rich enough but not too lean to fit the complexity of the task. Media selection according to this framework, taking place separately for each educational task within a course, may be characterized as a bottom-up design process.

4. A Social-Influence Approach to Media Selection: Core/Complementary Media

The second conceptual framework which we present in this paper, core/complementary media [Verwijs 98], is an example of a social-influence approach to media selection. Central starting point for the core/complementary media framework is that, in practice, the main medium for a course is often decided in advance, before the instructional-design process starts. Possible reasons for this are, for example, that a certain medium has been used for years already in the particular course or in similar courses; that the instructor is used to the medium; or that the medium selection has been 'imposed' by others (management, a client). The major part of the course will then be carried out through this medium: it is the *core medium* (the 'major' medium) in a media mix.
Limitations of the core medium are then dissolved by utilizing one or more *complementary media*. Using only one medium is often insufficient to attain all course goals; it is more efficient to add a specific medium that is

more appropriate for carrying out particular tasks or reaching certain goals. The educational tasks or goals for which the core medium is not particularly appropriate are then performed or achieved through complementary media.

For example: in recent years computer-assisted instruction has often been used in education and training. In general, these computer programs are very suitable for knowledge transfer, but are not very effective in the teaching of social or motor skills. Different media will need to be used which complement the CAI.

A second example is derived from distance education. Written materials have been the core medium in distance education for many years. With developments in information and communication technology (CAI, WWW, e-mail, computer- and video-conferencing as complementary media), certain course goals can be achieved better without requiring students to travel to face-to-face meetings.

The approach of combining core media and complementary media is not only applicable to hardware (such as selections between television, computer, book), but may also be used for software decisions. For example, if a decision has been made to use CD-I for a certain course (hardware), still decisions on how to design the CD-I (software) have to be made. In this regard a core medium, such as image stills with text, can be taken as a starting point, and the shortcomings of this medium can be complemented by using, for example, moving images and communication media for consulting a remote teacher. Now that multimedia is being used more and more, we expect that decisions on core and complementary media will be made more often on the software level.

Thus, in the core/complementary-media framework, a media mix consist of a core medium and one or more complementary media. The decision on the core medium is not made in a rational way, but is determined by influences of the decision makers in interaction with their social environment. Especially in the case of new technologies, decision makers appear to be sensible for influences from their social environment [Webster & Trevino 95].

The selection of (core) media is made on the course level, in an early stage of course development. In this regard, media selection is a step in a top-down instructional-design process; the selected core medium determines to a large extent the design of the course.

In summary: According to the social-influence approach, media selection is determined in the decision maker's social environment, and decisions are based on their preference and experience. Media-selection decisions are made on the course level and often in advance; media selection may thus be characterized as a design decision in a top-down educational-design process. The medium selected in this way is the core medium in a media mix. Besides the core medium one or more additional media are used to compensate for the limitations of the core media in certain educational tasks; these are the complementary media in the media mix.

5. Complementarity of the Approaches

We have distinguished rational-choice approaches and social-influence approaches, and have discussed an example of both approaches: task/media fit and core/complementary media, respectively. These two conceptual frameworks should be considered as guidelines which instructional designers may use in deciding on media. In particular, we argue that designers should view rational-choice and social-influence approaches as complementary, and should combine frameworks such as task/media fit and core/complementary media. In doing so, their media selection process becomes a creative, heuristic process, in which they combine bottom-up and top-down ways of working. By combining rational-choice and social-influence approaches disadvantages of one type of approach can be dissolved by applying the other type of approach. The approaches thus complement one another [Webster & Trevino 95].

By applying a rational-choice approach such as task/media fit, optimally effective and efficient media selections can be made for each educational task. However, this may easily result in a large, diverse, fragmentary, and hard-to-implement media mix for the whole course. Also, rational-choice approaches do not take into account the media and facilities which are already in use or available in the educational setting; this applies even more to the media-selection models we mentioned earlier. For implementation this is a disadvantage, both from a social-organizational and from a cost perspective. These disadvantages may be taken care of by applying rational-choice approaches in a flexible way. By applying a social-influence approach, such as core/complementary media, at the same time, a core medium for the whole course and other available media may direct the process of media selection per task.

Vice versa, the application of only a social-influence approach, also if this occurs in a conscious way, has an important disadvantage. The educational designer is not easily inclined to look beyond the collection of familiar media or the new media which the client likes to see used. This may easily result in sub-optimal media selections.
This disadvantage may be relieved by considering the best medium for each separate educational task, followed by a cost/effectiveness estimation of the replacement of the medium that would otherwise, from a social viewpoint, be preferred. Furthermore a rational-choice approach to media selection may provide convincing arguments to experiment with media which have the potential to yield better learning results, or to prevent decision makers from wasting money on fancy but inappropriate media.

In practice media selections often seem to be made impulsive or badly-reasoned, which some may judge as 'wrong'. We doubt if the latter can be justified: in such cases the designer may be acting on a basis of educational knowledge and experience combined with knowledge of the actual and aimed-at situation [Verwijs 98]. [Webster & Trevino 95] found that for new media the social-influence factor is more important than for traditional media, because the application and way of using of traditional media are well accepted and clear. A client may view a certain type of medium as an important element of the aimed-at situation; a medium in a particular educational situation which is selected based on trends or hypes that a client wishes to join ("We must have multimedia!"), may be viewed as a decision that can be rationalized in retrospect.
Rational-choice and social-influence approaches thus cannot be viewed separately from one another in practice. Their application though may be made more effective. Instructional designers who have to decide on what media to use should be conscious of the advantages and disadvantages of both rational-choice and social-influence approaches, and act upon this. This implies combining bottom-up and top-down design processes, in which the optimum middle will be different for each educational situation.

6. Summary

In summary, we have presented the following guidelines for media selection:

1. Consider for each particular educational-design situation what is an 'objectively' optimum choice for each particular task (rational-choice approach), and combine this with the best choice within the social context (social-influence approach)
2. Consider task/media fit as a rational-choice framework, and core/complementary media as a social-influence framework for thinking about media selection
3. Approach media selection as a creative and heuristic, combined bottom-up/top-down design process, in which the guidelines above may serve as resources

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